

TWO NEW SUBSPECIES OF *TROPAEOLUM* (TROPAEOLACEAE)  
FROM THE IV REGION (COQUIMBO), CHILE

DOS NUEVAS SUBESPECIES DE *TROPAEOLUM* (TROPAEOLACEAE)  
DE LA IV REGION (COQUIMBO) DE CHILE

John M. Watson\* and Ana R. Flores\*

ABSTRACT

Two new subspecies of *Tropaeolum hookerianum* Barn. are described. Apart from *T. hookerianum* subsp. *austrorubrum* presented here, only one other Andean-Pacific temperate *Tropaeolum*, *T. azureum* Bert. ex Colla, has blue to purple flowers. The second taxon, *T. hookerianum* subsp. *pilosum*, is distinguished by pilose pedicels, a feature unique among Andean-Pacific temperate species. Both novelties are Chilean endemics restricted to the IV Region (Coquimbo), as also is the nominate subspecies. All three are allopatric, and considered together extend the species' range to the north, to the south and to the east. Their characters and interrelationships pose implications for *Tropaeolum* evolution which are likely to be of interest to exponents of phylogenetics (cladistics), phenetics (taxometrics) and other disciplines. Descriptions and a key are provided, and aspects of morphology, ecology and distribution discussed.

KEYWORDS: *Tropaeolum* L., flora of Chile, Coquimbo, endemics, new taxa.

RESUMEN

Se describen dos subspecies nuevas de *Tropaeolum hookerianum* Barn. Además de *T. hookerianum* subsp. *austrorubrum* J. M. Watson & A.R. Flores presentado aquí, sólo otro *Tropaeolum* de la zona templada andino-pacífica, *T. azureum* Bert. ex Colla, tiene flores de color que va de azul a morado. El segundo nuevo taxon, *T. hookerianum* subsp. *pilosum* J.M. Watson & A.R. Flores, se distingue por sus pedicelos pilosos, un carácter único entre las especies templadas del sector andino-pacífico. Ambos nuevos taxones son endémicos chilenos y están restringidos a la IV Región (Coquimbo), igual que la subspecie típica. Los tres son alopatricos y en total extienden el rango de la especie hacia el norte, el sur y el este. Sus caracteres e interrelaciones se hallan involucrados en la evolución del género, que parece ser de interés a los exponentes de la filogenética (cladística), la fenética (taxometría) y otras disciplinas. Se provee de descripciones, una clave y se discute aspectos de su morfología, ecología y distribución.

PALABRAS CLAVES: *Tropaeolum* L., flora de Chile, Coquimbo, endémicos, nuevos taxa.

INTRODUCTION

*Tropaeolum* (ca 88 spp., Central America to Patagonia) is represented in Chile by 18 species and one widespread natural hybrid, all of section *Chilensia* Sparre. The taxa detailed below raise from four to seven the infraspecific elements of section *Chilensia*. (Sparre & Andersson 1991; Hoffmann *et al.* 1998; Watson, *ined.*)

Barnéoud (1846) described *T. hookerianum* (in Gay (1845)) from *type* material collected at Talinay, Limarí province, by Gay. The nature of the species' predominant clusters of flowers was observed and explained by Skottsberg (1950). Sparre & Andersson (*op. cit.*) noted *T. hookerianum* as endemic to a rather limited coastal area of Coquimbo region, and common around the Rio Limarí estuary (Fray Jorge, Talinay). They discounted as aberrant a record from Ñuble (Buchenau 1892). The taxa most closely related to *T. hookerianum* are *T. brachyceras* Hook. & Arn. to the south (IV to V Regions) and *T. beuthii* Klotzsch of littoral desert oases (II Region), northernmost of the section.

\*Fundación Claudio Gay, Alvaro Casanova 613, Peñalolén, Santiago de Chile.

## MATERIALS AND METHODS

As part of a wider study of the genus, several short excursions were made during 1997 into areas of the IV Region where *Tropaeolum* species had been observed many years before by one of ourselves (Flores), or are known to occur. The first phase, in September, involved locating and collecting flowering material: the second, in November, revisiting the same sites during the fruiting stage. Voucher specimens were taken, later to be deposited in SGO, CONC and K. This present study utilised any which corresponded with basic characters of *Tropaeolum hookerianum* s.l., including from most of its previously known range. Comparisons were made and relevant literature was studied, notably the most recent taxonomic revision of the Tropealaceae by Sparre & Andersson (*op. cit.*).

## DESCRIPTIONS AND DISCUSSIONS

*Tropaeolum hookerianum* Barnéoud subsp. *hookerianum*, in Gay, Fl. Chil. 1: 415. 1846.

The characterisation (in part) of *T. hookerianum* by Sparre & Andersson (*op. cit.*) in their key states: "Flowers usually borne in clusters of 3-5...". The main description amplifies this: "Flowers borne singly at nodes, but nodes in clusters of 2-8 along stem with often less than 1 mm in between..." Our field observations and voucher material reveal this fasciculation to be an inconstant feature. Nor is it unique to *T. hookerianum*. An example of that species from Fray Jorge shows a continuous (lower) flowering stem with 16 consecutive solitary pedicels and nodes spaced at intervals of 1 cm. Above this point on the stem the typical clustering formation predominates. The same tendency, though less extreme, was noted at El Teniente. Solitary flowering nodes may alternate with clusters along the stem, although in general solitary and fasciculated sections tend to be relatively discrete. Our impression is that solitary sequences occur as a rule on lower sections of the stem where floration commences, or on less vigorous shoots. Individuals from populations of other species recently sampled by ourselves also display dense, unmistakable nodal fasciculation: *T. tricolor* Sweet from Coquimbo province south Los Vilos (Flores

& Watson 8813, SGO) and the base of Cuesta Buenos Aires (Flores & Watson 8845, SGO): *T. beuthii* (Flores & Watson 8990, SGO) from the Papos district.

*T. hookerianum* s.l. may always be distinguished from these and other taxa by reliably constant alternative features such as petal dimensions and spur data.

*Tropaeolum hookerianum* Barnéoud subsp.  
*austropurpureum* J.M.Watson et A.R.Flores,  
subsp. nov.

CHILE, IV Región, Choapa Province, Panamerican highway, near the Padre Hurtado monument S of road junction to Combarbalá, 100 m, 12-IX-1997, Flores & Watson 8553 (SGO holotype; CONC, K isotypes).

*A. T. hookeriano* Barnéoud subsp. *hookeriano*  
*et T. hookeriano* subsp. *piloso* J.M.Watson et A.R.  
*Flores colore purpureo florum et distributio discreto*  
*australi differt.*

Slender, delicate climbing herb, prostrate only in rare absence of support, 3 m or usually less long, from subterranean tuber, glabrous throughout. Leaves estipulate; petiole to 15(-20) mm; blade divided almost to base into 5-6 radiating, narrowly lanceolate to obovate segments, 3-14 x 1-6 mm, obtuse to subobtuse; one segment of blade usually mucronate or retuse with a mucro. Flowers arising singly from nodes, but these commonly in dense aggregates of 2-9 along stem, at least in upper section of stem. Pedicels to 50 mm. Calyx lobes subequal, oblong, obtuse, 6-8 x 3-4 mm, dull purple, often tinged green and dark-veined; spur stout, conical, 5-6 mm long, 4-8 mm wide at base, pale greyish, veined dark purple-violet, apex subobtuse. Petals subequal, much exceeding calyx lobes, 10-15 x 5-9 mm, subspathulate, emarginate to subentire, purple or very rarely white, veined darker at base. Fruit a trimerous schizocarp as brown, dry mericarps 4-5 mm long of which 1-3 may develop.

**DISTRIBUTION AND HABITAT.** A strikingly beautiful subspecies, apparently confined to Choapa province by major valleys to the north and south. The present known longitudinal range is from near Las Palmas (31°17'S), some 30 km south of the nearest observed site of subsp. *hookerianum* (El Teniente, 31°05'S),

to just beyond the Padre Hurtado monument (31°30'S). It is locally rather common in many valleys alongside the Panamerican highway, including around the road junction to Combarbalá. Its status inland of the Panamerican is unknown, apart from one record shortly eastwards beside the road to Combarbalá (P. Riedemann, pers. comm.). Although not rare overall, subsp. *austropurpureum* should be classified as potentially vulnerable to large-scale disturbance such as highway development and commercial seed collecting.

Like subsp. *hookerianum*, the present subspecies is adapted to the humid, hilly coastal strip directly influenced by variable Pacific winter rainfall and frequent fogs. It inhabits species-rich valleys with an ephemeral spring floration followed by a long, arid period of drought. Shrubs and taller armed succulent elements form an important protective and supportive framework.

**NOTES.** The etymology of subsp. *austropurpureum* is intended to convey the importance and decisiveness of the geographically correlated difference between it and ssp. *hookerianum*. The overall segregation of the two flower colours is complete and mirrors the physical separation of both taxa. It is reinforced by uniformity of colour throughout the gross population of each subspecies and total lack of intermediates. One random white form of subsp. *austropurpureum* has been recorded in habitat.

*T. hookerianum* subsp. *austropurpureum* has been raised and flowered in Europe during 1999 from a small and responsible introduction by seed. It has already gained prizes and is regarded as showing considerable horticultural promise.

*Tropaeolum hookerianum* Barnéoud subsp.  
*pilosum* J.M. Watson et A.R. Flores, subsp. nov.

CHILE, IV Region, Elqui Province, Quebrada Maitencillo, 16 km N of Andacollo, 400 m, 21-IX-1997, Flores & Watson 8580 (SGO holotype; CONC, K isotypes).

*T. hookeriano* Barnéoud subsp. *hookeriano* *aspectu similissimo, sed pedicellis pilosis; differt a T. hookeriano subsp. austropurpureo* J.M. Watson et A.R. Flores *pedicellis pilosis et colore flavo florum.*

Slender, delicate climbing herb, prostrate only in rare absence of support, 2 m or usually less long, from subterranean tuber, glabrous except for pedicels and stems. Stems puberulous. Leaves estipulate; petiole to 15(-20) mm; blade divided almost to base into (4-)5-6 radiating and lanceolate, oblanceolate, ovate or obovate segments, 4-12 x 1-7 mm, obtuse, one segment of blade often mucronate. Flowers arising singly from nodes, but these commonly in aggregates of 2-4 along stem, at least in the upper section of stem. Pedicels to 30 mm, strongly pilose at base, less so above halfway to glabrous at apex. Calyx lobes subequal, oblong, obtuse, 6-8 x 3-4 mm, yellow-green; spur stout, conical, 5-6 mm long, 5-6 mm wide at base, yellow-green, apex subobtusate, somewhat darker green. Petals subequal, much exceeding calyx lobes, 8-12 x 5-8 mm, subspathulate, emarginate, yellow, more or less dark red-veined at base. Fruit a trimerous schizocarp as brown, dry mericarps 4-5 mm long of which 1-3 may develop.

**DISTRIBUTION AND HABITAT.** Known only from the type gathering. As observed it is not uncommon within its very localized colony. Conservation status: rare and consequently vulnerable.

Although its habitat area is still affected by coastal Pacific winter rainfall and fogs, subsp. *pilosum* clearly experiences a somewhat more arid and rigorous climatic regime than the other two subspecies. It inhabits the lower section of a south facing hillslope, one side of a steep river valley. Vegetative cover consists of small scrub patches or individual shrubs with rather bare, stony and rock-strewn stretches in between which briefly support a thin, ephemeral spring cover of annuals.

**NOTES.** Apart from its geographical distribution pattern, subsp. *pilosum* is unique and unexpected in one morphological particular. With three exceptions, previously known taxa from section *Chilensia* are glabrous. Those three display minor, variable or transient indumentum features and include, significantly, subsp. *hookerianum* as sometimes finely puberulous (Sparre & Andersson, *op. cit.*). Subsp. *pilosum* is therefore the first taxon of the section with well-developed indumentum. Equivalent consistent diagnostic hair occurs in 17 or more taxa from other sections endemic to intertropical and subtropical South America. At least

13 of these have some degree of regular pedicel pilosity. Sparre and Andersson note a further 28 from these sections with indumentum as a contingent character. Section *Chilensia* was regarded by them as primitive and essentially glabrous. Consequently they considered the presence of hairs in more recently evolved lines as likely to be a derived character.

On the basis of our present knowledge, subsp. *pilosum* classifies as a single-site, vicariant holoendemic (Richardson 1978), perhaps a relict. A few other taxa in section *Chilensia* are notably narrow endemics (cf. *T. rhomboideum* Lemaire), but only the cordilleran *T. jilesii* Sparre (of suspected recent hybrid origin, thus neoendemic) shares single site status (Sparre & Andersson, *op. cit.*). Subsp. *pilosum* is located 30 km due inland from Guanaqueros Bay, while the nearest recorded site for subsp. *hookerianum* (Altos de Talinay) lies some 50-60 km to the southwest. The intervening coastal plain evidently lacks suitable habitat. We speculate that continuing tectonic uplift in an area of shallower continental shelf, Guanaqueros Bay, may quite rapidly have distanced subsp. *pilosum* from the coast and its congeners, while at the same time gradually elevating it. Its sole known locality now appears to be effectively isolated. As a result this subspecies has perhaps been unable to expand its range.

The mixture of grouped and separated flowers noted above for subsp. *hookerianum* also corresponds in the two new subspecies. It is particularly common in subsp. *pilosum*, where clustering is less marked, giving a greater proportion of solitary flowers and a maximum of four pedicels per node-fascicle, as recorded.

### CONCLUSION

We strongly suspect that pollinator preferences account for the purple corolla of *T. hookerianum* subsp. *austropurpureum*, probably also in the context of a floral guild (cf. Cocucci & Sersic 1992). In our judgement its utterly distinct flower coloration and the notable indumentum feature presented by *T. hookerianum* subsp. *pilosum*, considered in conjunction with the geographical isolation of both, clearly warrant recognition at some taxonomic level. While the two new entities are insufficiently differentiated from *T. hookerianum*

subsp. *hookerianum* to justify recognition as full species, all three do fall very naturally into a group of allopatric subspecies.

### Key for distinguishing *Tropaeolum hookerianum* s.l. and separating its subspecies

Pedicels and nodes usually or occasionally borne in dense separate clusters of 2-9, at least in distal section of stem;

- 1a. Pedicels and nodes occasionally borne in dense separate clusters. Spur slender ..... 2
- 1b. Pedicels and nodes usually borne in dense separate clusters. Spur conical, 5-6 mm long; petals 8-15 mm long. (Coquimbo region only) ..... 3
- 2a. Spur 20-25 mm, petals shorter than calyx lobes. .... *T. tricolor*
- 2b. Spur 8-10 mm, petals 11-12 mm, distinctly longer than calyx lobes. (Antofagasta region only) .... *T. beuthii*
- 3a. Pedicels not pilose: (near coast) ..... 4
- 3b. Pedicels distinctly pilose: (inland, below Andacollo) ..... *T. hookerianum* subsp. *pilosum*
- 4a. Flowers yellow. (Altos de Talinay to El Tiente) ..... *T. hookerianum* subsp. *hookerianum*
- 4b. Flowers purple. (Panamerican Highway: La Palma to Padre Hurtado monument). ..... *T. hookerianum* subsp. *austropurpureum*

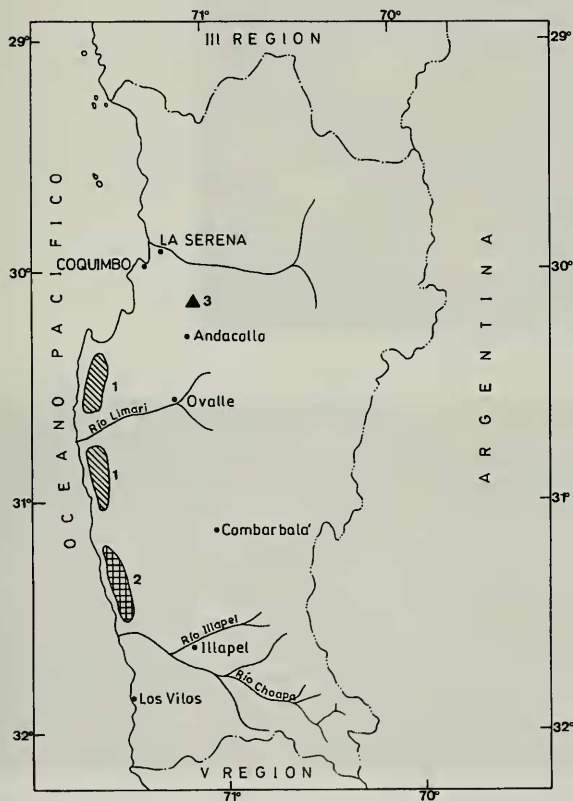
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
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IV REGION  
 COQUIMBO  
 CHILE  
 DISTRIBUTION  
 OF THE  
*TROPAEOLUM*  
*HOOKERIANUM*  
 COMPLEX

1   
*Tropaeolum*  
*hookerianum*  
 ssp. *hookerianum*

2   
*Tropaeolum*  
*hookerianum*  
 ssp. *austropurpureum*

3   
*Tropaeolum*  
*hookerianum*  
 ssp. *pilosum*

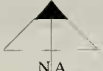
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FIG. 1. *Tropaeolum hookerianum* ssp. *pilosum*



FIG. 2. *Tropaeolum hookerianum* ssp. *austropurpureum*